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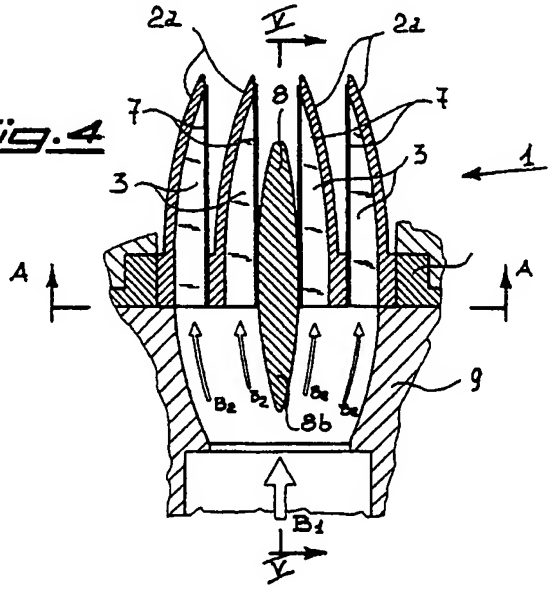
(54) Non-return valve of the flap type for flow concentration.

(57) A one-way flap valve, particularly for induction pipes of cylinders of internal combustion engines of vehicles, comprising a number of modular passage units (2) having substantially curved base walls (2a) and having internal dividers (2b) parallel to the side walls, capable of engaging frontally with flexible air-tight closure flaps (7) to form air flow channels (3), said modular units are arranged in the pipe in various positions, with at least one of them having an outlet flow direction different from and convergent towards those of the other units, a distance piece (8) having a profile curved according to the deformation curve of each flap of the adjacent units being placed between the unit with a different outflow direction and the adjacent unit.

Fig.4



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NON-RETURN VALVE OF THE FLAP TYPE FOR FLOW CONCENTRATION

The present invention relates to a non-return valve of the flap type for flow concentration, particularly for use in engines of the internal combustion type.

It is known, that, in internal combustion engines with fixed timing of the distribution, the selected angles of advance of the opening and lag of the closing of the valves, particularly the inlet valves, are optimal only at certain speeds, while at other speeds they represent a compromise which is sometimes barely acceptable.

Thus it is found that the inlet valves are opened while the discharge valves are still open (crossover), and while this promotes the discharge or the spent gases trom the cylinders at certain speeds, at other speeds it causes a return of the spent gases from the exhaust system to the cylinders and even into the induction pipes, thus decreasing the volumetric efficiency of the engine.

In some cases, moreover, in order to improve the refilling of the cylinders at high speeds, the inlet valves are closed by inertial and resonance effects after the start of the compression stroke.

However, at low speeds, owing to the reduced inertia of the charge entering the cylinders, at the start of the compression stroke a considerable part of the charge may flow back into the induction pipes through the inlet valves which are still open, with partial evacuation of the cylinders.

To eliminate these disadvantages, it has been proposed that the induction pipes should be provided with non-return valves capable of permitting the flow of air or mixture into the cylinders and of preventing a reverse flow to the exterior, restraining the charge flowing back from the cylinder into the induction pipes.

For this purpose, numerous embodiments of non-return valves of the flap type known in the previous art have been used; however, these have the disadvantage of feeding inio the induction pipes volumes of air which flow in parallel entry directions as a result of the uniform orientation of the exit direction of the air flow from the flap units of the valves; the volumes of air supplied in this way have a very wide flow section, a low relative density, and a low velocity of entry into the combustion chambers of the cylinders, particularly at low speeds, and consequently the air flow may become turbulent, thus counteracting the desired injection of mixture into the combustion chambers of the cylinders, while promoting, as a result of the low inertia of the air supplied in this way, the return of air into the feed pipe during the time interval required for the cylinders to enter the compression phase and close the inlet valves.

Consequently there arises the technical problem of producing non-return valves of the flap type which cause flows of air with directions converging towards a single central plane, or alternatively towards a number of planes arranged in any way which provides a higher relative density and higher entry velocity of the flow, to pass into the feed pipes of the inlet valves of internal combustion engines, in order to obtain an improved feed of the mixture to the cylinders and avoid the partial evacuation of the cylinders before the closure of the inlet valves

This technical problem is solved by using a non-return valve according to the present invention, which specifies a one-way flap valve particularly for inlet pipes of cylinders of internal combustion engines of vehicles, comprising a number of modular passage units having substantially curved base walls and having internal dividers parallel to the side walls and capable of engaging frontally with flexible air-tight closure flaps to form air flow channels: these modular units arc arranged in the inlet pipe in various positions, with at least one of them having an outlet flow direction different from and convergent towards that of the other units, a distance piece having a profile curved according to the deformation curve of each flap of the adjacent units being placed between the unit with a different outflow direction and the adjacent unit.

In the one-way flap valve according to the invention, the modular units are arranged with outlet directions which may be symmetrical about a plane or about two planes perpendicular to each other, or perpendicular to planes at acute angles to each other.

The distance piece of adjacent modular units with different and convergent outlet directions should preferably be extended into a feed pipe supplying air to the one-way flap valve to form a bulkhead dividing the feed flow and directing it towards the individual flow channels of the valve.

Further details may be found in the following description of an example of the embodiment of a valve according to the present invention, with reference to the attached drawings, which show the following:

in Fig. 1, an example of a modular unit forming a component of the valve;

in Fig. 2, an example of a flexible flap;

in Fig. 3, an example of the partial assembly of the flap valve;

in Fig. 4, an example of a valve according to the invention, seen in a section along the plane IV-IV in Fig. 5;

in Fig. 5, the valve seen in a section along the

plane V-V of Fig. 4;
in Fig. 6, the valve seen in the direction A-A of Fig. 4;
in Fig. 7, the partial and schematic section of an engine with a valve according to the present invention fitted in an induction pipe;
in Figs. 8a and 8b, plan views of examples of different configurations of the valve.

With reference to the figures, a preferred form of the non-return valve 1 according to the invention consists of a set of modular passage units 2 having substantially C-shaped sections with curved base walls 2a and internal dividing walls 2b arranged parallel to the side walls 2d of the unit 2, to form a set of air flow channels 3.

On the lower part of each unit 2 there are integrally formed blocks 4 having axial holes 4b and transverse holes 4a to allow connection to each other and to a stepped end piece 6 (Fig. 2) which also has transverse holes 6a for the passage of a suitable fastening element to secure the units 2 as a single block and axial holes 6b for the passage of means of fastening to the fixed body of the engine for the installation of the valve 1.

The blocks 4 also have transverse dimensions greater than the corresponding dimension of the block 2, thus providing a step 4c extending across the whole width of the unit 2.

Flexible flaps 7, in the form of an inverted T, and also having holes 7a for the passage of the fastening means, are arranged so that they contact the upper surfaces 2c of the dividing walls 2b and side walls 2d; when the assembly of the whole valve unit is complete, these flaps 7 are held in place by the step 4c and form an air-tight closure of the flow channels 3.

In a preferred example of assembly (Fig. 4), the valve 1 consists of two pairs of modular passage units 2 whose flow channels 3 are closed in an air-tight manner by the flaps 7 and and are orientated with the outlet directions of the flow converging towards a single central plane of symmetry, while the central and adjacent units 2 are spaced from the centre by a distance piece 5 which itself has a profile with external walls curved according to the curve of deformation of the flaps 7 for which they provide a stop.

In the example shown in the figure, the distance piece ih extended downwards by the part 8b towards the interior of a part 9 forming the air feed pipe to the valve; the distance piece 8 is also provided with holes 8a for the passage of the element which fastens and secures the whole valve unit; this element is not illustrated in the figure.

When the air flow is sent to the valve 1 through the pipe 9 in the direction of the arrow B_1, it encounters the extension 6b of the piece 8 and is divided and orientated in the directions of the arrows B_2, thus providing a better supply of air to the channels 3.

As shown schematically in Fig. 7, the valve unit 1 described above Ls fitted, in a way which is known and is therefore not detailed in the figure, to the feed pipe 10 of an inlet valve 11 immediately downstream of the inector 12; when the inlet valve 11 is opened to allow the induction of mixture, the pressure drop due to the action of the piston causes the deflection of the flaps 7, which lie against the curved wall 2a immediately downstream, thus permitting the passage of the air flow which, with the valve configuration described, has a very small surface section in relation to the section of a flow in a normal valve arrangement.

Thus the air flow is highly concentrated, with a significant increase in its relative density and velocity, permitting, among other thingsl a reduction of the section of the cylinder feed pipe 10.

Other arrangements of the modular units 2 to form the non-return valve 1 are also specified as variations; for example, the modular units may be arranged in a triangular configuration (Fig. 5a), or with symmetrical flow directions with respect to two planes which are perpendicular to each other, forming, for example, a square configuration (Fig. 8b).

Claims

1) A one-way flap valve, particularly for induction pipes of cylinders of internal combustion engines of vehicles, comprising a number of modular passage units having substantially curved base walls and having internal dividers parallel to the side walls, capable of engaging frontally with flexible air-tight closure flaps to form air flow channels, characterized in that the modular units are arranged in the pipe in various positions, with at least one of them having an outlet flow direction different from and convergent towards those of the other units, a distance piece having a profile curved according to the deformation curve of each flap of the adjacent units being placed between the unit with a different outflow direction and the adjacent unit.

2) A one-way flap valve according to claim 1, characterized in that the modular units are arranged with outlet directions symmetrical about a plane.

3) A one-way flap valve according to claim 1, characterized in that the modular units are arranged with outlet directions symmetrical about two planes which are perpendicular to each other.

4) A one-way flap valve according to claim 1, characterized in that the modular units are arranged with outlet directions perpendicular to planes which are at an acute angle to each other.

5) A one-way flap valve according to claim 1,

characterized in that the distance piece of the adjacent modular units with different and convergent outlet directions should preferably be extended into a feed pipe supplying air to the one-way flap valve to form a bulkhead which divides and directs the feed flow.

Fig. 1

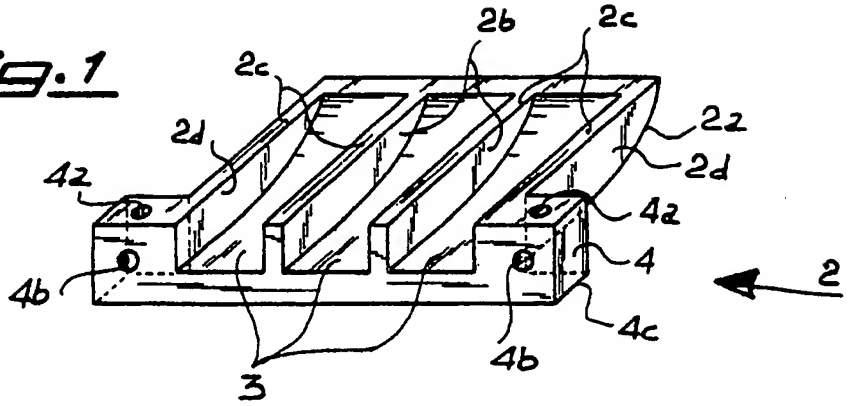


Fig. 2

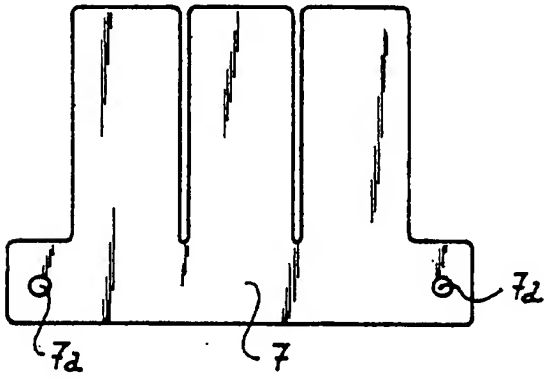


Fig. 8a

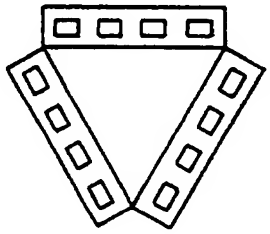


Fig. 3

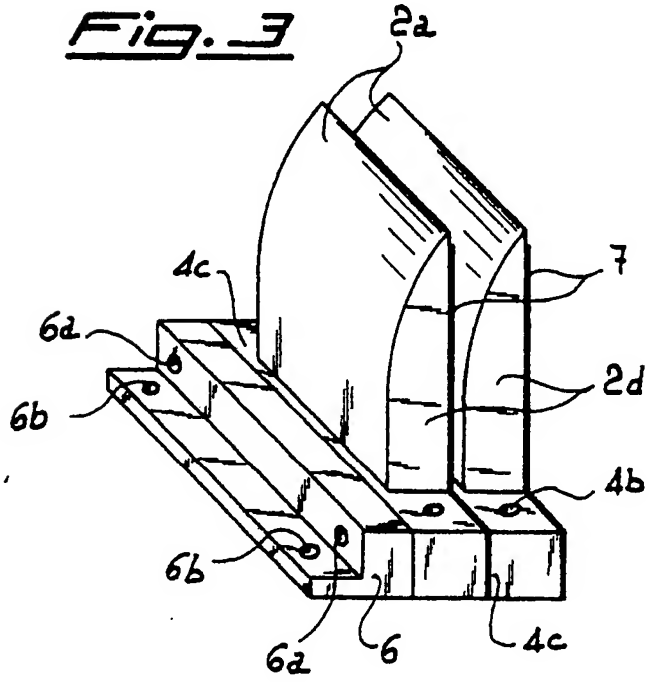


Fig. 8b

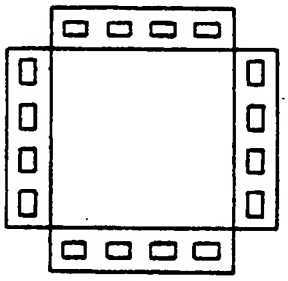


Fig.4

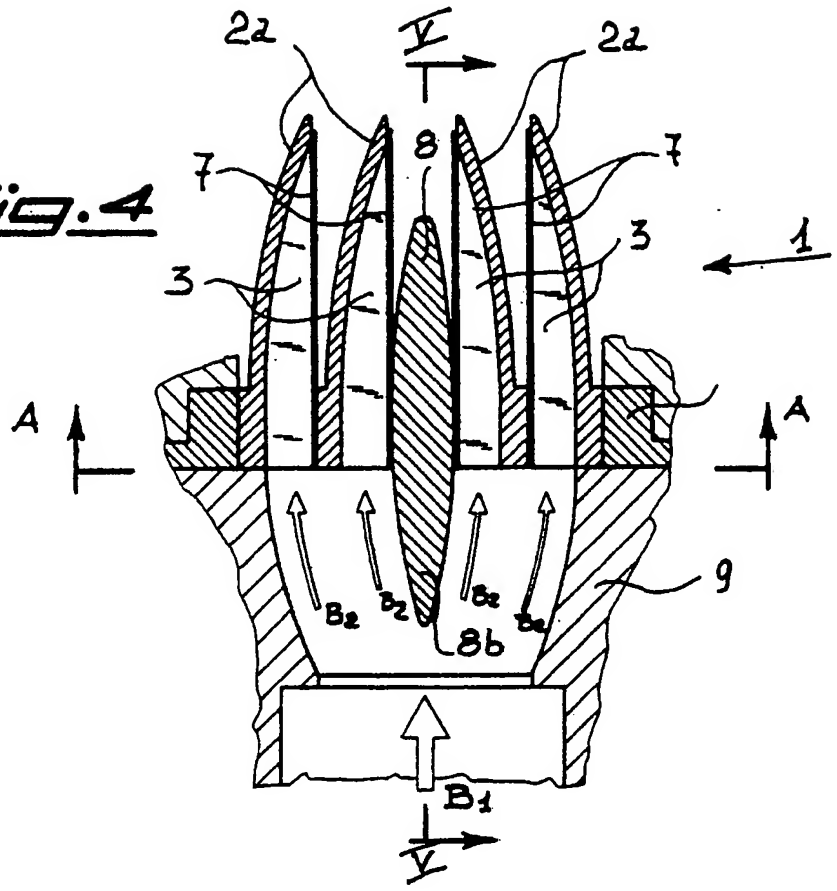


Fig.5

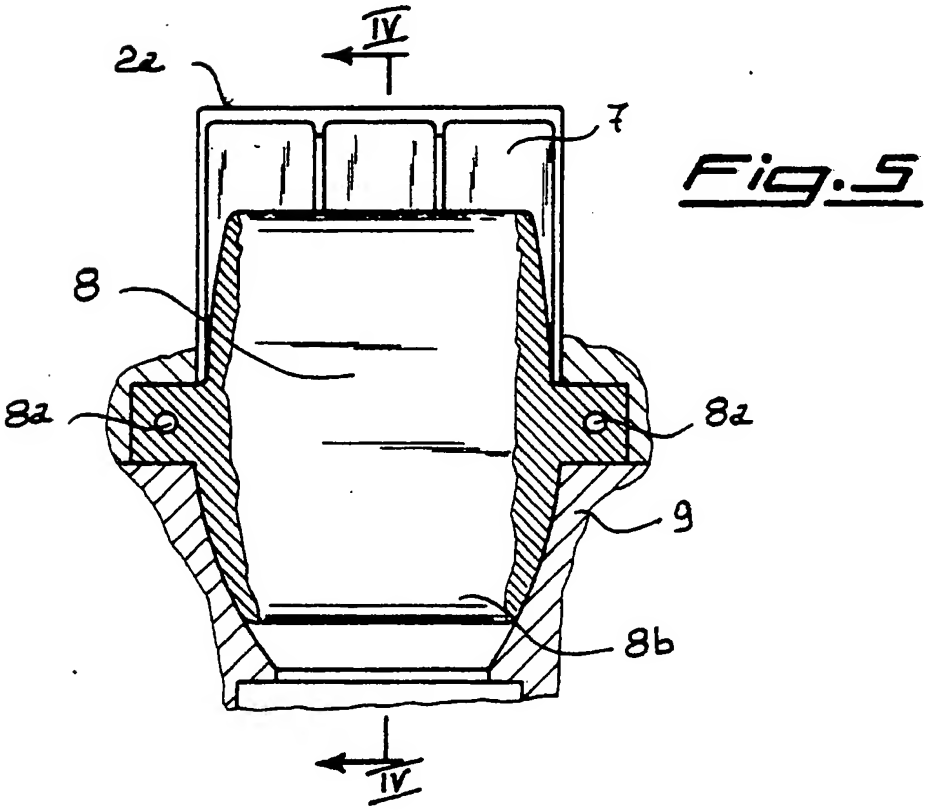


Fig.6

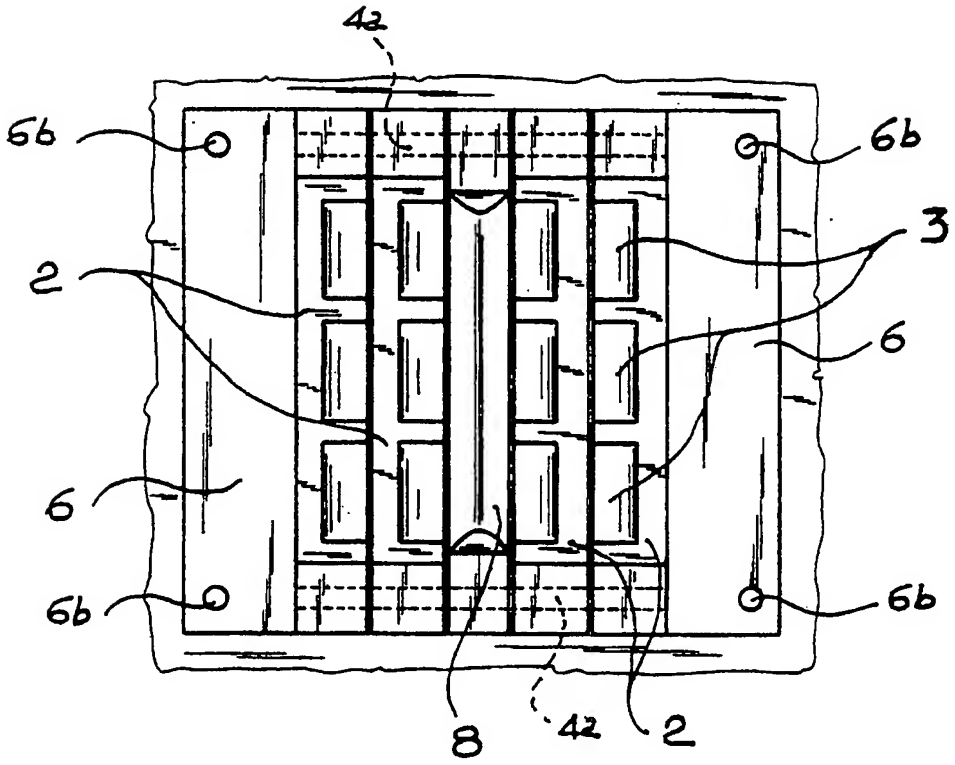
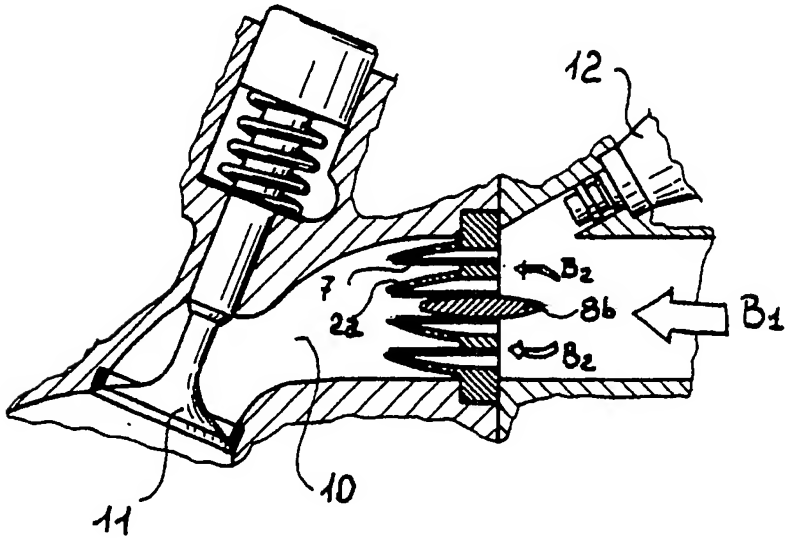


Fig.7



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EUROPEAN SEARCH REPORT

Application Number

EP 90 20 2740

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	EP-A-0 337 520 (ALFA LANCIA INDUSTRIALE S.P.A.) * column 1, line 1 - column 2, line 53; figures 1-4 *	1	F 01 L 3/20 F 04 B 39/10 F 16 K 15/16
A	FR-A-2 040 829 (LENINGRADSKY NAUCHNO-ISSLEDOVATELSKY INSTITUT KHIMICHESKOGO MASHINOSTR) * page 2, lines 15 - 32 * * page 3, lines 29 - 40; figure 1 *	1	
A	US-A-4 228 770 (BOYESEN) * column 1, line 36 - column 2, line 34 * * column 4, lines 26 - 41; figures 1, 2 *	1	
A	FR-A-2 492 497 (ALFA ROMEO SPA) * page 2, line 32 - page 3, line 34; figures 1-3 *	1	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)
F 01 L F 04 B F 16 K

The present search report has been drawn up for all claims

Place of search	Date of completion of search	Examiner
The Hague	27 January 91	ALCONCHEL Y UNGRIA J.

CATEGORY OF CITED DOCUMENTS

X: particularly relevant if taken alone
Y: particularly relevant if combined with another document of the same catagory
A: technological background
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D: document cited in the application
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